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CHRISTMAS TREE FARMING

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Christmas Tree Farming

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A tree in the home at Christmas time has become a part of the holiday festivities throughout the United States. In response to this yearly demand, a business enterprise has sprung up to harvest, distribute, and retail the trees in that brief period from late October to late December.

In the early days wild stock from the forest was used exclusively. As larger areas of forest land were cleared, attractive bushy trees were found in pastures or cut-over swamps. For perhaps a hundred years here in the Northeast, pasture land and swamp provided all the Christmas trees for the growing communities. With the awakening interest in conservation and reforestation during the early decades of the current century, hand-planted Christmas trees began to appear on the market — first as thinnings from plantations slated for timber, then as a crop in their own right. Although the amount of planted stock today probably is not more than 30 per cent of the total volume marketed in this State, the trend certainly is toward the plantation-grown rather than the wild tree. The number of land owners who have already gone into the business of Christmas-tree growing in this State, and the inquiries regarding this enterprise that come to the New York State College of Agriculture every month, indicate that the proportions may well be reversed in a short time. This is as it should be. A plantation-grown tree well spaced and well cared for while growing easily surpasses wild stock cut from the tops of half-mature trees in the swamps or selected from clumps growing wild in pastures.

Theoretically, Christmas-tree farming could be overdone. If in this State all the millions of acres of cleared idle land ideal for Christmas trees were planted to suitable species, New York could supply the Nation for a long time. Actually, as already intimated, the growing of Christmas trees as a business is still in its infancy. As the enterprise develops and expands, quality, as with any other product, will always command a market. Even with a falling market, the Christmas-tree grower can allow most of the trees to stand and develop into other merchantable crops, such as pulpwood and saw logs.

Who Will Go into Christmas-Tree Farming?

Christmas-tree farmers may be classified in three distinct groups: (1) the "plunger type" who

goes into the business in a big way — buys up hundreds of acres of land and, his rotations once established, sells trees annually by the carload lot; (2) the town or city resident who falls heir to or buys a bit of land in the country, and, not wishing to farm, decides to put it into Christmas trees; and (3) the farmer already on the land who plants Christmas trees to supplement his income. In the long-time view, the farmer is most likely to receive the greatest return for each acre of land growing a tree crop.

Mass operations can bring spectacular returns, but there is always the hazard that fire, insects, or diseases may destroy the partially grown crop. Theft, labor difficulties, transportation tie-ups, and heavy snows at harvest time all beset Christmas-tree growers, but the investment in land for Christmas trees by the town or city resident or that by the farmer is minor and the loss or failure to market one year is not so crippling as for the man with many acres in trees alone.

The distant owner of Christmas-tree plantations must remember that unless he gives the trees the proper care his chances of making a profit are negligible. The idea that all he has to do is to set out a block of trees and come back at the end of ten years and receive a good cash return is erroneous. Such stock when ten years old is no better than wild trees; in fact, if planted on too fertile soil, they may be even less saleable because of too rapid height growth. Such a stand seldom yields more than 30 per cent saleable trees. Even if an absentee owner actually tends his Christmas-tree planting each year until it is ready to harvest, he must pay for protection against theft, pay for harvesting and hauling, and must locate and maintain a suitable market. If he sells the trees standing, he pays these costs in a greatly reduced price per tree. If the buyer chooses and cuts the trees, there is likely to be nothing but scrubs left.

All things considered, the man who really profits from Christmas-tree farming is the landowner, usually a farmer who sets aside a definite area on his farm (5 acres or 500) and takes up the enterprise with the same planning and management that he devotes to other crops. He plans a rotation and plants accordingly. It is for such an owner that this bulletin has special interest.

Choice of Planting Site

ANY land that is *well drained* and free from large woody vegetation will probably grow Christmas trees. It does not have to be the poorest land on the farm either, because the annual return per acre from a Christmas-tree plot once it is established and underway may well compare favorably with that from other farm crops such as buckwheat. The one definite drawback to land that has been recently under cultivation, especially if it has been heavily fertilized, is the competition

from annual vegetation. This necessitates cultivation or mowing for several years, which is an added expense. Furthermore, because of this combination of cultivation and previous fertilization, growth may be so vigorous and rapid that the trees are too coarse for quality Christmas trees.

Among the most beautiful Christmas trees produced in the United States are black spruce from the swamp bogs of Minnesota. Under those adverse conditions growth is extremely slow but the resultant trees when 6 feet high are compact and bushy without pruning.

Open hilltop land that supports a sparse growth of goldenrod, so common throughout New York State, is generally satisfactory for Christmas trees. In such sites the land needs no previous fitting nor any subsequent cultivation. In the shallow Volusia soil of the Allegany Plateau in central and southwestern New York, where as the saying goes "the soil heaves to the second rail on the fence," the loss from heaving may be severe in soils too thin to support a sod. On the other hand, in some Christmas-tree plantations in the Hudson Valley, the annual growth of weeds and grasses is so vigorous, because of good soil, that the lower two or three whorls of branches of Christmas trees have been completely shaded out. Each tree has the appearance of being on stilts. No particular harm is done, but the trees will need that much more growth to reach a merchantable size because the tree must be cut above the dead branches, or a program of mowing must be carried out.

Christmas trees do not grow well on poorly drained land. The balsam fir, one of the most popular of Christmas trees, is at home in the Adirondack swamps but does not thrive under similar moisture conditions when set in plantations.

How Much Land to Plant

How much land to plant depends, of course, on how much land of the right sort is not now being used to better advantage. Also, how much time can be given to this crop each year? Are the markets near at hand and is there keen competition from wild stock? Whatever the decision in terms of trees to be cut each year, only enough land to furnish that number eight or ten years hence is needed. Allowance is, of course, made for some losses in planting and some while growing; a few trees, too, on each acre never would make good saleable Christmas trees regardless of how the tops were worked. Each year an equal area is planted until the first planting is ready to harvest, for example, at ten years of age. After harvesting, the area is replanted the following spring; thus a rotation is established and the supply is annually replaced to take care of demand.

For example, suppose that a nearby market could readily use 1000 trees a year and that land and time are available to handle such a crop.

Assume, also, for purposes of calculation, that an acre of land is required to furnish 1000 trees 6 feet high at ten years of age. This is a generous figure because 1000 trees can be harvested from less than an acre. Ten acres of land would be needed and that is all. If a species that takes 15 years to reach a suitable Christmas-tree size is chosen, then 15 acres is needed to keep the annual harvest of 1000 trees coming after the fifteenth year.

No greater mistake in Christmas-tree farming is made than to rush into the project rather blindly, plant a lot of acres the first year, and then sit back and wait for the trees to mature. When they do mature, there is the pressure to harvest all before they get too large and then, just when valuable experience in harvesting and marketing is gained, the "bottom drops out of everything" because there are no young trees to replace those harvested.

If a lot of land is available or if land can be readily acquired at a modest price (land suitable for Christmas-tree growing in the Southern Tier can be bought for $5 to $20 an acre), there is always a question of location. In a plantation along a well-traveled road, trees can easily be taken out in those occasional winters of heavy snows; but it is usually necessary to establish a patrol from early December to Christmas to prevent theft. Also, there is the risk of fire from cigarette stubs tossed from passing automobiles. The maintenance of a fire line is the best possible insurance against the carelessly tossed cigarette butt. If the plantation is in an obscure spot far from prying eyes, there is the added expense of transportation, often by team, to care for and to market the trees. Each grower has to determine for himself which is the lesser of the two worries. The experience of many growers would tend to favor the relatively remote and inaccessible area.

What Is a Christmas Tree?

So far, the general all-inclusive term Christmas tree has been used to imply most any evergreen or, more properly, conifer. In addition to being an evergreen, a Christmas tree should: (1) be symmetrical, with evenly spaced lateral branches, preferably horizontal; (2) have side branches stout enough to hold ornaments and other items with which it is usually adorned (that eliminates the cedars); (3) have the ability to hold needles well after being brought indoors; (4) have a distinctively and agreeable fragrance and odor of the woods.

Three groups of evergreens, or conifers, are in common use as Christmas trees; pine, spruce, and fir. Native hemlock is not grown as a Christmas tree in New York because planting stock is not available. Furthermore it drops its needles when taken indoors and is too limp a tree. In the three groups, the following species are being suc-

cessfully grown in New York: (1) *pine:* red, Scotch, Austrian, white; (2) *spruce:* Norway, white, blue; (3) *fir:* balsam, Douglasfir (Rocky Mt. variety). The grower's choice of planting stock should be limited to these nine major species. Those experimentally inclined may want to try Fraser's and Concolor fir, or a couple of spruces such as Black Hills or Engleman's.

The Pines

It is only within the past few decades that pines have appeared on city markets, and then chiefly in western Pennsylvania cities (Pittsburg and Erie) and in the Buffalo area of western New York. In other areas though, pines are becoming more popular. They have the advantage of holding their needles well and are extremely rapid growers as compared with spruce or fir. On the other hand, pines are likely to present a too open, scraggly appearance as compared with the compact spruce or fir, because in all pines there are no branchlets between the whorls of prominent laterals that mark each year's growth in height. Often the growth rate of the lateral branches almost equals that of the leader and gives the tree a bushy globular effect instead of the narrow cone-shape of the spruce or fir.

Red Pine

The long, dark-green needles give the red pine a luxuriant appearance. Unfortunately, the framework of coarse branches shows through the foliage. To many persons it leaves much to be desired as a Christmas tree. The growth rate is rapid, too rapid in fact to be a good Christmas tree since it means excessive space between the side branches. It should not be planted on poorly drained and alkaline soils.

Red pine is susceptible to some damage in this young stage. A wet, clinging snow can bend down and actually tear out branches from the trunk.

Rabbits and mice in certain years have been known to kill a whole plantation by gnawing off the bark at the base of the trunks.

Among insects, the pine sawfly and European pine shoot moth seems to be the most serious.

The larvae of the sawfly hatch in early summer and, clinging together in great masses, begin systematically to eat up the foliage of branch after branch. Fortunately, in plantations up to Christmas-tree size (6 feet) the pine sawfly is easy to control by knocking the huge clusters into a can. Dusting with D.D.T. and/or stomach poisons is also effective if the infestation is heavy and extensive.

The pine shoot moths appear during late June and early July depositing eggs near the tip of the twig. The eggs hatch in 10 days and larvae bore into the needle bases, later migrating to hibernate in the buds. Low temperatures (from —10°

to −20° F.) control the insect as do parasites. Sprays may be used on ornamental trees. Red, Scotch, and Austrian pines are attacked.

Scotch Pine

Scotch pine is preferable to red pine. Its growth habit is less coarse, its needles are shorter and stiffer, and the whole appearance is much more compact. If measures are taken to prevent too rapid height growth, Scotch pine has excellent possibilities as a Christmas tree in many parts of the State as it grows on a variety of sites.

Unfortunately, the blue-green foliage which makes a block of Scotch pine so distinctive in the growing season is not maintained on all strains or varieties throughout the winter. On the other hand, strains of Scotch pine from the Baltic provinces are far less susceptible to snow damage than are the wider branched strains from more southerly regions of Europe. In certain plantations, the heavy snows of 1944–45 rendered unfit for future harvest about 30 per cent of blocks of young Scotch pine. Of the two evils, the change of color with the advent of freezing weather is the lesser. Undoubtedly, strains will eventually be developed that combine both features for the Christmas-tree market. Scotch pine is also susceptible to girdling by rodents. Losses to Scotch-pine plantations through deer browsing are many in open winters such as that of 1951–52. Scotch pine is also attacked by the European pine shoot moth, the white pine weevil, and the spittle bug.

The amazing growth rate of young Scotch pine as compared with that of any other Christmas tree listed, together with its ability to hold needles when brought indoors, no doubt outweighs its risks and disadvantages when the market not only accepts but, in some sections, demands this species. The progressive grower, however, always depends on more than one species for his total yearly harvest.

Austrian Pine

For those who desire a long-needled Christmas tree, the Austrian pine, a European species, satisfies the need. Long (sharply pointed) needles, dark green color, and large attractive buds and heavy twigs have made this species increasingly popular each year.

The tree is easily grown but in the early stages may grow slower than red pine. It is planted on moist or well-drained soils, particularly those where the lime content is fairly high. It attains saleable size in from 8 to 10 years.

Austrian pine appears to be more resistant to European pine shoot moth than does red or Scotch pine, though the buds are sometimes attacked. Sawflies may also defoliate the tree. Austrian pine is very brittle, making handling difficult. Pruning is needed less than on Scotch pine.

White Pine

White pine satisfies a need in certain restricted markets. It grows well on a variety of sites and supplies the market with a limber, blue-green tree of "soft" appearance. Since the white-pine weevil readily attacks it, and those not attacked grow extremely rapidly, its usefulness as a Christmas tree is limited. The weevil may be controlled by cutting the wilted leaders in early July and burning them. Subsequent pruning is necessary to produce a well shaped tree.

The Spruces

The spruces have long been favorites as Christmas trees because of their compact bushy growth and general conical shape. They are practically immune to snow damage and grow fairly rapidly after the first few years.

Norway Spruce

Probably 60 per cent of the Christmas-tree plantations of the State are Norway spruce. The needles are rather long and of a dark, lustrous green. The growth for the first five years is likely to be discouragingly slow, but they make superior table trees if there is a market for such stock. For the next five years, the leader shoots up rapidly so that the whole tree has a "leggy" appearance which depreciates its value as a Christmas tree. Without pruning, not more than 30 per cent of a block of Norway spruce will be saleable at 10 years of age as really quality Christmas trees.

Unless the butt is immersed in water, the Norway spruce soon begin to lose needles when brought into the house. Even when standing in water, needles drop off before New Year's Day, especially if the tree is jarred or brushed against.

The Norway spruce has four insect enemies that can cause serious losses before the trees are ready to harvest. They are the white-pine weevil, the spruce-gall aphis, the spruce sawfly, and spider mites.

The white-pine weevil kills back the terminal growth, causing several laterals to take its place. Because of the habit of Norway spruce to shoot up a spindly unbalanced leader, this damage is not so serious. It results in a sort of crude pruning that can be supplemented by a judicious use of the pruning shears. It is better, however, to go over the plantation rather thoroughly by the time it is 4 feet high and cut out and burn all the dead tops. This should be done early in July. In this way weevil damage can be kept to a minimum.

The spruce-gall aphis causes the black cone-like growths found on the lateral branches. If the infestation is heavy, it is best to cut and burn the affected trees. It is possible to control the spruce-gall aphis if a spray is applied at the right time in the spring. Most Christmas-tree growers will not find it practical, however, to be on hand with the knapsack spray at that time. In

most plantations the loss from this source has been less than 2 per cent.

Unlike the sawflies that appear in great masses on the pines, the green larvae of the spruce sawfly appear singly. From their color it is almost impossible to detect them feeding on the needles. Branchlets stripped of their green needles is the surest evidence of their presence. The infestation over the State so far has not been serious enough to hurt the sale of trees 6 feet and less in height. On some of the older trees, 25 or more feet high, scattered branches are more or less defoliated, particularly on the northern side. A serious infestation can be checked with lead-arsenate spray or with DDT dust.

If the foliage looks dwarfed, stunted, and is of unhealthy green color, and later falls off, probably the tree has a heavy infestation of spider mite. It is best to cut and burn such trees before the damage spreads or to spray or dust with a proprietary miticide.

White Spruce

White spruce, a native of the Adirondacks is a bluish-white tree with a typical "woodsy" odor but not the resinous fragrance of other spruces and firs. It apparently holds its needles better than either the wild red spruce or the Norway spruce. Some buyers insist that the bluish green needles are not so acceptable to the trade as are the dark green of the Norway spruce or the balsam fir, while others favor it. There can be little validity to their criticisms, however, in view of the popularity in some markets of the Scotch pine which also lacks this dark-green foliage.

In growth habit, the white spruce tends to be more cylindrical than the Norway spruce. It can be planted closer than can Norway spruce without loss of needles on the lower branches due to shading. Its growth rate is more uniform once it is established than that of the Norway, and it reaches average harvest height (6 feet) in from seven to nine years, instead of from eight to ten which is customary with Norway spruce.

The white spruce seems less susceptible to gall aphis and sawfly attack than is Norway spruce, and few evidences of white-pine weevil attack have been noted. The damage by spider mite is greater to white than to Norway spruce, but still not serious enough to call for the use of sprays or dusts.

Blue Spruce

Where an especially white or bluish-white color is desired, the blue spruce satisfies a need. The needles of the tree are long for a spruce, very sharp, at right angles to the stem which is stout. The tree, in sizes for Christmas tree use, is full in appearance. Like all spruces it is slow to start and does best on moist clay or on loam. It matures in 12 to 18 years and requires little or no pruning. Its needle-holding ability is similar to that of Norway spruce.

Figure 1. A 7-foot white spruce 9 years after planting

In any lot of blue-spruce seedlings the color will vary from green to true blue thus the ornamental blue spruce is usually propagated vegetatively. The worst insect enemy is a gall aphid similar to those on other spruces.

The Firs

Without question the firs are "tops" when it comes to Christmas trees. The trees of this group are uniform and symmetrical and the foliage is an attractive dark green. The superior holding quality of the needles when brought indoors is noteworthy.

Balsam Fir

All that has been said about firs in general apply to the native balsam fir, and in addition the needles have that pronounced and characteristic fragrance which brings a scent of the North-woods indoors. Furthermore, it is practically immune to the insect pests that bother the spruces. On its performance, balsam fir should be the tree above all others sought by Christmas-tree farmers. Really good blocks of planted balsam fir, however, are scarce in this State, although planting stock was available for two decades.

Indications are that balsam fir is rather exacting in the sites on which it will grow satisfactorily, especially when south of its natural range in the Adirondacks.

Just off the Cornell campus a block of balsam fir on excellent loam ranges, after 20 years' growth, from 8 to 10 feet in height and has none of the vigor that is characteristic of the tree in its native habitat. At an elevation of 1800 feet, balsam fir is doing well on heavy soils; even here trees at the bottom of a 25-degree north-facing slope are more vigorous in size and height than are those at the top. On sites that are more moist, verging perhaps on a springy condition, balsam fir may be expected to take longer to reach harvesting size if it survives. It takes from 10 to 12 years to get a well-filled out, symmetrical, 6-foot balsam fir under such conditions.

Every Christmas-tree farmer may want to try some balsam fir on the more moist part of his planting area, not on the driest sites. *It would be well, however, not to plant too heavily* until experience has indicated just how well balsam fir will survive and thrive on that site.

Douglasfir

Douglasfir is not a true fir, although its common name would imply that. This tree is a native both of the West Coast and the Rocky Mountains. The Rocky Mountain strain is hardier here in the East than are other varieties, and is recommended for Christmas-tree plantations under certain conditions.

Douglasfir is without question the Christmas tree of the Northwest. Like the balsam fir, it does not

Figure 2. A 7-foot balsam fir twelve years after planting. Note the horizontal branches as contrasted with those of the spruce

Figure 3. A 12-year-old Douglas fir

Table 1. Characteristics of seven conifers for Christmas-tree plantations

Characteristics	Pine			Spruce		Fir	
	Red	Scotch	Austrian	Norway	White	Balsam	Douglasfir
Years required to reach 6 feet in height	5 to 7	5 to 7	8 to 12	8 to 10	7 to 9	10 to 12	12 to 14
Needle-holding ability indoors	Good	Good	Good	Poor	Fair	Good	Good
Number of insect species that attack tree	2	2	2	4	3	0	0
Amount of pruning or other work to control height growth	Some	Great deal	Some	Great deal	Some	Slight	Slight
Susceptibility to snow damage	Heavy	Heavy	Some	None	None	None	Slight
Susceptibility to girdling by rodents	Heavy	Heavy	Some	None	None	None	Heavy

lose its needles under the most adverse indoor conditions. The "fill in" with smaller branches between the lateral annual branches is so complete that the tree has without pruning almost a sheared appearance. So far Douglasfir has shown little susceptibility to local native insects. Mice and deer cause considerable damage in many areas. It is extremely sensitive to frost damage and consequent stunting where planted in large blocks at high elevations. Smaller blocks interspersed with other species are probably desirable in such locations. Also, Douglasfir plantings confined to east-facing and north-facing slopes are less likely to be injured by late frosts. In lake plain areas, the species may be planted on many sites because of the freedom from late spring frosts.

In sections of the State on good well-drained soils and at low elevations where there is a question about the growth of balsam fir, it is suggested that Douglasfir be given a trial. Under average conditions it has taken Douglasfir 12 years to reach a harvest height of 6 feet (table 1).

Source of Stock

THE nurseries of the Conservation Department at Lowville, Lewis County, and at Saratoga, Saratoga County, are the chief source of Christmas-tree planting stock. The Department has ruled that this nursery stock may be purchased for Christmas trees, provided the trees are harvested by severing the trunks and not by digging up the roots to sell living specimens in competition with those from private nurseries. One must order a minimum of 1000 trees of one species. If trees are received free under provisions of the Forest Practice Act, 500 trees per acre must be left for a forest stand where Christmas trees are harvested.

Landowners who desire to purchase planting stock in more limited quantities, in larger sizes, or without restrictions as to subsequent use of the trees, may do so from commercial nurseries. At present some small New York commercial nurseries handle evergreen stock and there are several large establishments in nearby States. For more information about these sources of trees, one may write to the Department of Conservation at the New York State College of Agriculture at Ithaca, New York.

Usually for each species offered for sale commercially, there are two classes of stock: seedlings and transplants. Seedlings are stock that has been grown in seedbeds, usually for two years though sometimes they are held for an additional year. Those held are then designated as three-year seedlings. Seldom is it advisable to hold coniferous planting stock in seedbeds for more than three years. If the seedlings are not sold, the seedbeds are dug up and the seedlings are set in rows and kept under cultivation for a year. The following year this stock would be designated as *3–1 transplants*. Obviously, the price of transplants must be higher than that for seedlings because there is so much more labor as well as time involved. Generally speaking, it is recommended that the Christmas-tree farmer use three-year seedlings or transplant stock, either 2–1 or 2–2. The extra cost of large stock can well be afforded in view of the quick returns, as compared with returns from other forest crops. It is especially desirable to use transplants where existing vegetation on the planting site offers serious competition.

Spacing the Trees

How far apart each way should Christmas trees be planted? There are two schools of thought.

If Christmas trees are to be an intermediate crop and taken out at least theoretically as a thinning, then it would certainly be advisable to space the trees fairly close together; for example, 4 by 4 feet. This gives 2,720 trees to the acre (table 2). If at from eight to ten years of age 1500 trees could be thinned, more than 1000 trees would be left to continue growth into pulpwood or sawlogs. This is the cheapest way to get back the initial costs of land purchase and planting. Under such a plan, the trees to be left after Christmas-tree harvest could be other varieties; for example, European larch or even some hardwoods. One experienced grower in Cayuga County claims that Norway spruce grown under ash and red oak tends to be less leggy and less subject to insect at-

Table 2. Spacing of Christmas trees and number of trees to the acre

Spacing	Trees to the Acre
Feet	*Number*
4 by 4	2720
5 by 5	1740
6 by 6	1210
7 by 7	890

tack than when grown alone. In his plantation, the hardwoods were planted somewhat in advance of the spruce.

The other school of thought takes the position that Christmas trees should be considered not as an intermediate crop but as a definite harvest on a 7- to 15-year rotation. All trees should be cut at the end of the rotation, and the area replanted at once. The writer has followed this general plan, but a few scattered specimen trees that would otherwise have to be cut and burned when the area was prepared for the next planting he has developed by pruning, because of an unusual local market for trees from 10 to 15 feet high. Under a clear-cutting plan, a spacing of about 5 by 5 feet is satisfactory, especially for white spruce and the firs.

On Norway spruce, the lower lateral branches are longer than on other species and 5-by-5-foot spacing gives each tree only 2½ feet. To allow all the Norway spruce to reach 6 feet before harvest, would damage the interlacing lower branches. This difficulty can be partially prevented by harvesting some trees at a height of 4 or 5 feet.

With land for planting relatively cheap and plantiful, *it is better to err on the side of a wider spacing.* If more than one species is used, it is preferable to plant each species in a separate block to simplify cultural practices and insect control during both the growing years and the harvest.

Planting Methods

THE grub hoe still rates as the best all-around tool for planting trees in the heavy stony soils that make up such a large part of New York's abandoned, or idle, farm land. The grub-hoe slit method of planting is described in Cornell Extension Bulletin 226, *Forest Planting on the Farm.* By this method it is possible for two men to plant 200 trees an hour, with a tree survival of about 90 per cent.

On the first planting of a well-drained area, the work can be hastened materially by plowing shallow furrows on the contour at 5- or 6-foot intervals and then setting the young trees at regular intervals in the furrow. A trowel or some other device is used to pull the soil over the well-spread roots. This method should be used only where an adequate snow cover prevents heaving. For successive plantings in that area, the stumps and roots would make the use of the plow unsatisfactory, and many replant the area before entirely removing the previous crop. The seedlings apparently thrive in the partial shade. Recently tree-planting machines have hastened the job and the results are excellent if care is used in planting.

Protection and Care of the Plantations

THE chief enemies of a Christmas-tree planting while it is growing to maturity are livestock,

fire, insects and disease, rodents, adverse weather, competition of volunteer hardwoods, and thieves.

Livestock

Livestock should never be permitted access to a growing plantation. Hundreds of potential Christmas trees can quickly be ruined by cows trampling the plantation and breaking the side branches. A stout fence is the answer. Fences will not retard deer from making use of the area, however, and damage to seedlings by browsing may be serious. Hunting should be encouraged to reduce deer and rabbit population.

Fire

It is hard to conceive of anything in the outdoors more inflammable than a young coniferous plantation coming up through the dried grass. That is one good reason to locate it away from well-traveled roads and the flung cigarette butt. Small plantings in blocks, freed of inflammable material by annual disking and with well-defined roads between, is the best protection. Kindly disposed neighbors and fire wardens who will drop everything and help when an emergency arises are also important. A knapsack pump filled with water should always be in readiness at the farmstead.

Fires must be reckoned as a constant hazard to Christmas-tree growing during the critical spring and fall period. No insurance that anyone can afford is available as yet in this State.

Insects and Diseases

In the 10- to 15-year life of a Christmas-tree crop, few diseases offer a serious threat to growing a satisfactory crop. With insects, the story is quite different. These have already been discussed under the various tree species.

In general, it may be said that constant vigilance is well rewarded. That is one reason why the distant absentee owner "loses out." He has no time during the growing season to make frequent visits so necessary if a full measure of health is to be accorded the growing trees.[1]

Rodents

Rodent damage is largely confined to the pines and is more apt to be severe on heavy sod. In orchards, similar damage is prevented by use of poison bait. In times of high mouse populations such techniques may be justified in a Christmas-tree plantation.[2] Encouraging natural predators on mice, rabbits, and red squirrels might in the long-time view be the better solution.

Adverse Weather

Little can be done about the weather. If there is a dry summer, the mortality of that year's plant-

[1]The Department of Entomology at the New York State College of Agriculture will gladly identify insects, if specimens are sent to the College, and suggest methods of control.

[2]Further information on mouse control may be obtained from the Department of Conservation, Cornell University, Ithaca, New York.

ing will be high regardless of how carefully the planting was done.

Excessive snow, as has already been mentioned, is a threat to the pines but not to the spruce or firs. Planting pine in areas where previous observation indicates that snow drifts heavily even in a normal winter is to be discouraged. Late-spring frosts are always a menace to spruce and fir, especially at the higher elevations. It puts these species back a whole year to have the ½-inch new growth blackened by one hard freeze in May. Planting Christmas trees in frost pockets also is unsatisfactory – the Douglasfir and perhaps the spruce, will never get above them. Norway spruce is less susceptible to those frosts than is a white spruce. In general, trees planted on north and northeastern exposures, close to natural woodland, or among scattered high trees are less likely to be damaged by late-spring frosts.

Competition of Hardwoods

If the same area is to be used repeatedly for successive crops of Christmas trees, hardwoods sooner or later will invade the plantation. They must be checked and eliminated if they are not eventually to take over the planting site. With no existing woods nearby, this invasion will be delayed one or possibly two rotations. If the woods are adjacent or close by, invasion starts within a year or two. Where a hardwood stand borders the planting area, it is a constant and continuous struggle to keep seedlings and suckers of hardwood species from taking over the planting sites. Popple and pin cherry are the worst invaders because they spread both by seed and by suckers that come up from far-extending, near-the-surface roots. Cutting or chemicals retard these two weeds. Only pulling or grubbing keeps them down. Several growers use small power mowers between the rows, and after several cuttings have kept hardwoods at a minimum. One of the costs of Christmas-tree-plantation management that must be recognized is the labor involved in going over each acre of plantation once a year and pulling out these seedlings and suckers. If this work is neglected for several years, then the suckers are too well established to be easily uprooted by hand pulling; to grub them out, is a time-consuming operation. A spray of 2,4,5–T in fuel oil or kerosene may be applied during the dormant season to the lower 12 to 18 inches of the stem. When reasonable care is used the conifers are little damaged. Other invading hardwoods, such as white ash, soft maple, hard maple, and black birch, area readily controlled by spraying the foliage with a weed killer after the growth of conifers is stopped. A 2,4-D–2,4,5-T combination spray has been satisfactory except on ash. A knapsack sprayer may be used to apply this chemical, but care must be taken not to let the spray hit the needles of the young conifers.

It is best to fell large trees with axe or saw in late fall or early winter and then immediately paint the exposed stump with a 10 per cent solution of sodium arsenite. It is a waste of time to cut back young hardwood growth with a brush hook or machete without doing something about the stump, for the next year a flock of vigorous sprouts will replace the single stem.

In plantations far from woods, the invasion of hardwoods is a minor problem. Frost injury, however, may be severe because there is no protecting overwood.

Figure 4. Killing a sugar maple with sodium-arsenite injection. The Cornell tree-killing tool shown is used as a substitute for stump painting

Thieves

At current market prices for Christmas trees, loss from thieves is ever present, especially in plantations near large cities. If the trees are visible from a well-traveled highway, some growers have found it necessary to patrol their plantations night and day during December. Posting "No trespass" signs and getting the cooperation of the sheriff and local state police officer should not be overlooked. Current laws are ample to take care of Christmas-tree thieves, provided the grower is able to establish proof of ownership on a truckload of trees.

Pruning

Douglasfir and balsam fir, as already mentioned, usually develop into satisfactory merchantable trees without benefit of the pruning shears. This is to be expected where the yearly height growth is less than a foot and the terminal growth on laterals is in proportion.

Spruces

With spruces, however, there is a tendency for the young transplants to grow slowly and compactly for from four to five years and then to shoot up the leader at an accelerated rate. Unless this is checked, an unmerchantable tree results.

Pruning is required to keep the top as bushy and compact as the lower part of the tree. For this work, shears are the best tool. A satisfactory and convenient time to prune is from late June to early fall after height growth for the year is completed.

The vigorous leader is snipped off at a point from 6 to 8 inches above the last whorl of branches. Then to give better balance and more compactness, the leaders on all the lateral branches of the next two or three whorls are also shortened. This may be done in two ways: (1) by making the cut at the point where the lateral leader joins the whorl of branches or; (2) by nipping the lateral leaders back to give a better shaped cone. The cut quickly heals over, and there is no stub to stick out when method 1 is used. The tree is saleable that same winter after pruning. The following year, it will often be noted that two buds have developed and sent up leaders from a point immediately below the severed tip. It is easy to remove one of these leaders, and if necessary, again cut back the other.

Sometimes for the sake of symmetry and compactness, it may be necessary to cut back lower lateral branches near the ground. Just removing the leader of the year's growth is often not enough. It may be necessary to cut off the lateral growth of two or even three years, but always the same procedure is followed. The pruning is done at the whorl point so a stub is not left.

Speedier pruning could no doubt be done with hedge shears than with pruning shears, but the resultant effect would be far from

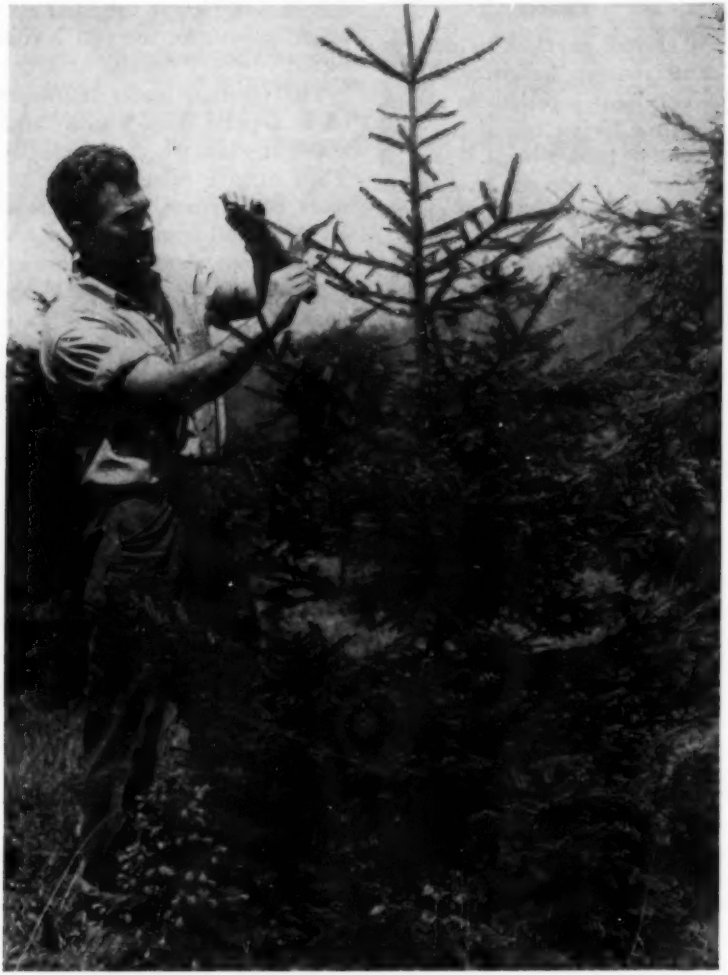

Figure 5. Late-fall pruning a 6-foot Norway spruce to be harvested the same year as pruned

Figure 6. Shaping a tall "turn up" Norway spruce with a pole pruner

Figure 7. Summer-pruning a Scotch pine to cut down height growth

pleasing, especially if it were planned to harvest the tree that same year. Once the technique is learned not more than a minute is required to "spruce up" a 5- or 6-foot tree. Operators report costs of 1 to 4 cents per tree for one year's pruning. Usually three prunings are enough to market the tree. More frequent and drastic pruning is required on Norway spruce than on white spruce.

If there is a local market for Christmas trees as tall as 15 to 20 feet, then this same pruning technique should be followed systemati-

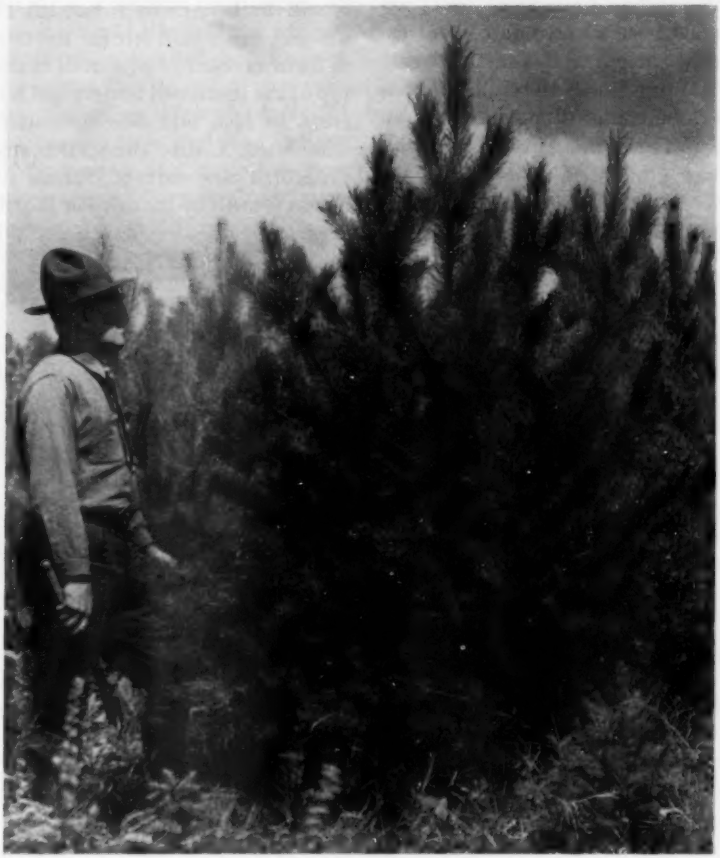

Figure 8. A 6-year-old pruned Scotch pine ready for harvest

cally to keep the tree shapely without having a "sheared" appearance. A pole pruner must be substituted for the hand pruner, and a great deal more time is required. The price obtained for these large specimen trees justifies the added expense.

Pines

With pine, quite a different technique must be used to control excessive height and lateral growth. The pines it will be recalled do not have buds and branchlets between the whorls that mark successive years' growth. If a portion of the leader is cut off after it is hardened, the stub may die back to the whorl point in the fall or winter, and the laterals will turn up to become leaders and thus form a ball-shaped Christmas tree. In any event the buds thus formed will be weak and less desirable than when pruning is done on time.

If, however, the leader and laterals are snipped back between mid-June and mid-July, while the leader is still limber, there is enough of the growing season left for the tree to form a cluster of new buds at the top of the shortened leaders and laterals. In fact, bud development is stimulated. Unlike the spruce and fir, Scotch pine starts to increase its height growth by the third or fourth year after planting, especially the

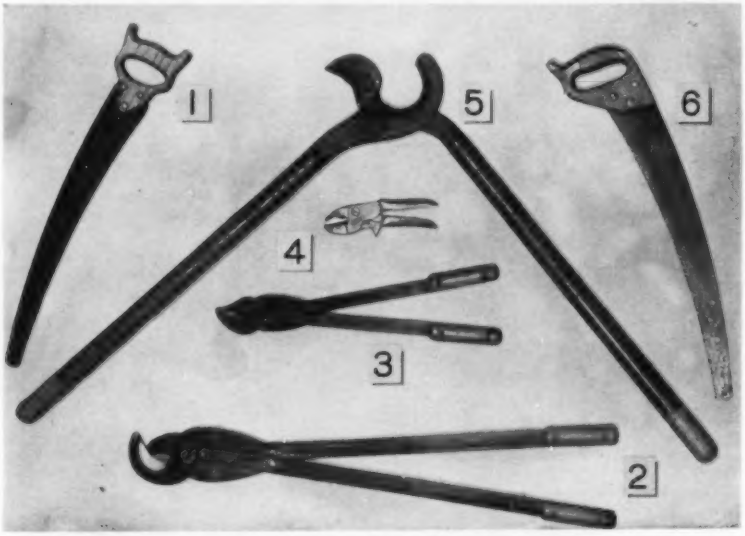

Figure 9. Tools used in pruning and harvesting Christmas trees: *1 and 6,* curved saws for harvesting; *2 and 5,* large pruners for harvesting; *3,* small pruner for developing turn-up tree; *4,* hand pruner.

four-year-old transplant stock. Frequently this annual height growth will be as much as 2 feet. Such wide spacing between laterals must be prevented if a compact bushy tree is to be developed. It is important, therefore, to start this early summer pruning by the third or fourth year and *to continue it regularly* until the tree is harvested. Because 12 inches is a satisfactory spacing between whorls, the leader is clipped off at that point and the surrounding shoots, the laterals of that year, are clipped at about the 8- to 10-inch point. New growth at the end of the laterals of the previous year also is treated this way. Pruning the ends of the growing branches encourages the formation of buds and thus a dense tree results.

Harvesting

WHEN is a Christmas tree merchantable? It's merchantable whenever there is a market for it. If the market calls for 3-foot table trees, and the grower can get 60 cents apiece delivered for these trees, that represents in the long-time view a better proposition than selling 5- to 6-foot trees at $1.25 five years later. Table trees are easily harvested, can be carried conveniently in the back of an automobile, and, of course, offer a quick turnover of investment.

For most householders, the favorite tree size is from 6 to 8 feet. Therefore, the rotation can be planned on the basis of making the first heavy cut when the bulk of the trees in any one block after the fall pruning are from 5 to 8 feet in height.

It helps greatly at harvest to have the trees tagged in advance. This may be done when the grower inventories his saleable stock during September or October to determine the number, size, and species. Even with pruning, not every tree down the row is ready to harvest in any one year. Many find that a block may be harvested in three to four years. It takes time to look at each tree and to decide whether it should be cut this year or later. A good way is to wire tags on the trees to be cut. The tags carry the height of the tree and the species. As one person attaches the tag, a second person records on a tally board the height of the tree and the species. This is time-consuming, of course, for the best one can do is to tag about 100 trees an hour, but at harvest time the whole job is so mechanical that a group of inexperienced cutters may be employed.

The best cutting tool is one of the stout curved pruning saws or the pointed bow-saw. For trees less than 2 inches in diameter at the point of cutting, hand pruners are slightly faster. Motor driven saws are sometimes useful.

The time to harvest also requires some decision. The longer cutting is delayed, the greater is the chance of running into a pre-Christmas snowfall that will seriously increase harvesting and hauling costs. The heavy December snows actually pre-

vented the harvest of thousands of trees in New York in 1945. It may be a good policy to cut pines and fir early, stack them in cold storage with the butts in wet sand or sawdust until time of sale.

From the standpoint of needle loss through early cutting, it makes no difference with pine or fir. With spruce, no difference in subsequent needle-holding ability has been noted between late-November and early December cut trees, provided the trees are stacked out of the drying wind with the butts in contact with the ground or moist sawdust.

Another advantage in the earlier cutting is higher temperatures. If trees are cut when the temperature is 10° F. above zero or lower, the side branches are so brittle with the frost that some are sure to break when the trees are packed in the truck or on the bobsleds. It is a good rule never to load trees when the temperature is below 20° F. if at all possible. Some growers avoid this condition by tying the trees on the stump ahead of cutting.

Most of the wild trees that reach urban markets have been tied and even bundled. This means that far more trees can be hauled at a load, but it also increases the cost of harvesting. For the Christmas-tree farmer who sells chiefly in a local market, with hauling distances short, tying the branches is an unnecessary expense. If temperatures are not much below freezing, two hundred 6-foot Norway or white spruce trees can easily be packed in an average-sized stake-body truck without tying and without damage to the trees. Experience, of course, increases one's ability to do a good job of loading. Perhaps three hundred balsam or Douglasfir of the same height could be put on one load. These two species have proportionately smaller boles and more flexible side branches. With the bushy Scotch pine, one hundred 6-foot trees would probably be a load. If the trees were first tied, probably the number on the load could be increased to two hundred. For transportation over any distance bundling is a necessity.

Marketing

IT is probably safe to say that Christmas-tree marketing is one of the most disorganized, uncontrolled enterprises in the State. The extremely limited marketing season accounts in part for this situation. In most years, however, the practice that really results in a supply greater than demand, with consequent bonfires, is consignment selling to retailers. Under this scheme anyone with a truck jumps into the game, makes a deal with a farmer to buy a truckload of trees at from 75 to 95 cents apiece on the stump, and hauls them in town to a gas station or perhaps to a grocery store. The middleman guesses how many he can sell and stocks accordingly. Since the trees are on consignment and he has to share with the trucker only on the trees sold.

he usually stocks considerably more than he requires "just in case."

In the face of this marketing situation which is everywhere prevalent in New York State (in some years before World War II whole carloads of west-coast trees were shipped into the State on consignment), the modest Christmas-tree farmer has two methods of being sure that all trees cut are sold and that he gets a fair share of the customer's dollar to repay him for the expense in planting, cultivating, and harvesting this crop. These are: (1) to sell direct to the public and (2) to sell wholesale.

Selling Direct to the Public

Where the Christmas-tree farm is near a good-sized city and is accessible by car even in times of heavy snows, the ideal way to market Christmas trees is at the farm. City people will drive for a tree just as they will for apples or other farm produce. In fact, they like to bring the children along to help pick out the tree. Once this market becomes known, the farmer finds himself literally swamped with customers in the few days just before Christmas. Time is not available to wander over the block with the customer to pick and cut any particular tree. The farmer must educate his customers to come out early in the fall to select and tag the tree and agree about subsequent delivery, or he must harvest ahead of his trade and let the customer select among the trees already cut as they are stood up close by to permit easy inspection.

Selling Wholesale

It is only the exceptional location that permit direct-to-customer marketing of Christmas trees. Most Christmas-tree farmers depend on a middleman to dispose of their crops. The things to avoid are to (1) sell on the stump and (2) sell on consignment. The farmer who harvests and hauls his own trees has that supplemental income from the crop.

Trees should be assembled, sorted, and graded at truck-loading points where they may be disposed of by the piece to buyers. Trees are not bundled until they are inspected by the buyer.

If trees are sold as stumpage, the owner has to take the buyer's decision and this usually results in high-grading, especially at the end of the harvest season.

Certified checks or cash should always be received before the trees leave the grower's premises. Some growers have been swindled by being of too trusting a nature.

New Trees Without Planting

Turn-up Trees

WHEN harvesting, the cut is usually made at ground level, so there are no stumps to trip over when replanting the area. If, however, the cut is made just above the last two whorls of live branches, these lower branches will not have died by the following summer. In-

Figure 10. New trees from one Norway spruce by a turn up (right), by one or two sprouts (right, top of stump), and by layering (left)

stead, like all conifers that lose their leaders, these lower branches turn up to take the lead themselves. By judicious selecting, pruning, and shaping-over for the next five or six years, a new Christmas tree can be developed on the old stump (figure 10). Probably not more than a year's time is saved in developing a second 6-foot tree, and the extra pruning required through the years will no doubt offset the planting expense of a new tree. For anyone who likes to see trees respond to the skilled use of the pruning shears, it is an interesting experiment to develop 8- and 10-foot trees for a special market. Quite often the turn-up trees by the time they have reached 6 feet in height are still not rounded out and require additional side pruning. By the time they are 8 feet in height, this difficulty has been overcome. If the same precaution of leaving live lower branches is observed at the time the second tree is cut, the process can be repeated. Eventually several trees would be developing simultaneously on the same stump.

Sprouts

Most conifers do not sprout. With Norway spruce, what amounts to the same thing as sprouting occurs when there is a goodly supply of live branches below the point of cutting on a stem that is 4 inches or more in diameter. In addition to the upturning laterals, dormant buds break through the bark just below the cut and develop exactly as would sprouts on a hardwood. If the cluster of sprouts is reduced to one or two, it is possible to develop from this source also another tree on the same stump.

Layering

A third method of vegetative reproduction is layering. If the lowest branches of a sizeable Norway spruce lie in contact with the ground long enough (from 5 to 10 years), roots develop. The branch tip beyond the point of rooting turns upward and soon a new tree is growing. Obviously, the Christmas-tree grower will not depend on this method of starting new trees because it takes too long.

Income Taxes

INCOME from Christmas-tree farming may be sizeable. The following suggestions may be amended by later rulings by the Bureau of Internal Revenue, so one should always check with the local office for up-to-date rulings.

The purchase price of seedlings and their planting costs are deductable expenses. Costs of pruning, shaping, and harvesting the trees are deductable as is any advertising cost incurred in selling the trees.

Summary

THE man who really profits from Christmas-tree growing is usually a farmer who sets aside a definite area of his land and takes up the enterprise with the same planning and management that he devotes to other crops. He plans a rotation and plants accordingly. It is for such an owner that this bulletin will have special interest.

Any land that is well-drained and free from large woody vegetation will probably grow Christmas trees. It does not have to be the poorest land nor the best. The returns from Christmas trees may compare favorably with those from a more intensive crop. Open hilltop land, now supporting a sparse growth of goldenrod, usually is satisfactory.

How much land to plant depends not only on how much of the right sort is now being used to better advantage but on how much time can be given the crop each year.

The choice of planting stock should be limited to any six species: red, Scotch, and Austrian pine; Norway and white spruce; and Douglasfir (Rocky Mountain variety).

Spacing of the trees depends on the management followed. With land for planting relatively cheap and plentiful, it is best to err on the side of wide spacing.

The chief enemies of a Christmas-tree plantation are livestock, fire, insects and diseases, rodents, adverse weather, competition of volunteer hardwoods, and thieves.

The plantation may or may not need pruning, depending on the species grown. Douglasfir and balsam fir develop into satisfactory trees without pruning. The spruces and pines, however, need some pruning.

When to harvest trees depends on the size demanded by the public. The trees should be selected carefully, and each one to be cut should

be tagged. The longer cutting is delayed, the greater is the chance of a snowfall that would increase the cost of harvesting and hauling. There is little difference in subsequent needle-holding ability between late-November and early-December cut trees, provided they are stored out of the wind with the butts in contact with the ground.

It is not advisable to load trees when the temperature is below 20° F. because many of the side branches break.

How to Care for Your Christmas Tree

Obtain freshly cut trees, store them until they are taken into the house in a cool shaded spot and out of the drying winds. Put the butts in water or in moist soil. When you place the tree in the house, make a diagonal cut on the stump from 3 to 4 inches away from the end. Place the tree in a tree-holder with a well for water, and keep the water level high while the tree is in use.

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